

REMARKS

The Examiner's indication that all of the items listed on Form PTO-1449 of the Information Disclosure Statement of March 8, 2004 is respectfully requested.

Additionally, as the Office Action of April 22, 2004 ("Office Action") is said to be responsive to the communication filed on December 12, 2003 (see Office Action, "Office Action Summary"), the Examiner's indication that the Supplemental Amendment of December 16, 2003 has been entered and considered is also respectfully requested.

In the Amendment of December 12, 2003 ("Amendment"), the specification was amended on pages 31 and 37. However, in reviewing that Amendment recently, it was discovered that the various added text in the replacement paragraphs for the amended text on pages 31 and 37 was, by inadvertence, not underlined. It is presumed that this added text was thus not actually added. Thus, the specification is hereby amended to remedy this inadvertent omission, by adding text in underline to the replacement paragraph on page 31 that was submitted in the Amendment and by adding text on page 37 that was not underlined in the Amendment as new text where no text presently exists. The amendments address various clerical, typographical, spelling, grammatical, or punctuation errors or oversights. No new matter has been added by virtue of these amendments to the specification.

Additionally, in the Amendment of December 12, 2003 ("Amendment"), the claims were amended to cancel claims, namely, Claims 1-23, and to add new claims, including Claim 32. However, in reviewing that Amendment recently, it was discovered that a reference to "1-23. (Cancelled)" was omitted, by inadvertence, and a reference to "32. (Original)" was used, by inadvertence, rather than "32. (New)". Herein, a reference to "1-23. (Cancelled)" and a reference to "32. (Previously Presented)" appear, reflecting the current status of those claims.

The Office Action Summary indicates that Claims 24-31 and 33-41 are pending, but also indicates that there is an objection to Claim 32. It is submitted that Claims 24-41 are pending, as are new Claims 42-70.

Claim 24 has been amended to recite the subject matter of now-cancelled Claims 36 and 40. The amendment of Claim 24 does not narrow that claim in any other respect. Each of Claims 24, 29-31, 33, 35, 37 and 41 has been amended to replace the word "a" with the word "the" before the word "group," merely to cosmetically amend the claim to address an alleged informality. These amendments do not narrow the claims and do not add new matter. Each

of Claims 38 and 39 has been amended to alter the dependency of the claim, given the cancellation of Claim 36, such that the claim depends from Claim 24. These amendments do not narrow the claims in any other respect and do not add new matter. New Claim 57, and new Claims 58-70 depending therefrom, recite a composition for chemical mechanical planarization of a surface having at least one feature thereon comprising copper, comprising: hydroxylamine in an amount sufficient for chemical etching of the at least one feature comprising copper; a material selected from the group consisting of hydroxylamine nitrate, hydroxylamine sulfate, an ammonium salt, and any combination thereof, the ammonium salt selected from the group consisting of a nitrate salt, a sulfate salt, a phosphate salt, a chloride salt, and any combination thereof; and an abrasive comprising alumina. These new claims are presented for the first time herein and thus have never been objected to, rejected, or amended in any manner.

The Examiner's indication that Claim 32 would be allowable if rewritten in independent form, as suggested in the Office Action, is acknowledged and appreciated. The Examiner states that his reasons for his indication of allowable subject matter are that "[n]o prior [art], taken either alone or in combination, discloses or renders obvious a chemical mechanical planarization composition, comprising: 4-hydrazine benzoic acid in combination with the limitations of base claim 24." (See Office Action, pages 6-7.) It is submitted that Claim 41 is directed precisely to this subject matter. Thus, the Examiner's action in withdrawing all outstanding rejections of Claim 41 and in indicating that Claim 41 is allowable is earnestly solicited. The Examiner's action in indicating that Claims 42-56, which depend from Claim 41, are also allowable, is earnestly solicited.

Herein, Claim 32 is maintained as written, as it is believed that Claim 32 is allowable based on the reasons set forth herein.

Claims 24, 29-31, 33, 35, 37 and 41 have been objected to based on an alleged informality. It is believed that these objections are moot, as remarked upon above. Therefore, withdrawal of these objections is earnestly solicited.

Claims 24, 30, 31, 35 and 41 have been rejected under 35 U.S.C. Section 102(b), as allegedly being anticipated by United States Patent No. 5,981,454 of Small (hereinafter, "Small II"). These rejections are respectfully traversed.

At the outset, it is respectfully requested that the Examiner withdraw the rejection of Claim 41 and indicate on the record that Claim 41 is allowed, based on the foregoing remarks, which are fully incorporated in this traversal by reference. It is respectfully submitted that, as conceded by the Examiner, Small II fails to teach or suggest a composition for chemical mechanical planarization comprising a combination of elements as set forth in independent Claim 41, as well as Claims 42-56 depending therefrom. An indication on the record that Claims 41-56 are allowed is requested.

As to the remaining rejections over Small II, the Examiner states that Small II fails to teach the recited composition comprising an abrasive, as now recited in Claim 24. (See Office Action, page 4.) Small II teaches that its abrasive-free Post Clean Treatment solution can be used to perform CMP of copper metal films, wherein this abrasive-free Post Clean Treatment solution is used to oxidize the copper metal surface and a separate slurry composition is used thereafter to abrade the resulting oxide surface. (See Small II: col.6, ll.2-6.) The Post Clean Treatment solution does not contain an abrasive and cannot be used alone to carry out the CMP process. Small II teaches that an abrasive slurry composition must be used after the abrasive-free Post Clean Treatment solution in the CMP process to abrade the resultant metal oxide surface. The only abrasive slurry compositions mentioned by Small II are silicon oxide-based slurries for which the pH is said to be important and needs to be in the 10 to 11.5 range. (See Small II: col.5, ll.31-33.)

It is submitted that Small II fails to teach or suggest a composition for chemical mechanical planarization of a surface having at least one feature thereon comprising copper, comprising: hydroxylamine in an amount sufficient for chemical etching of the at least one feature comprising copper; a material selected from the group consisting of hydroxylamine nitrate, hydroxylamine sulfate, an ammonium salt, and any combination thereof, the ammonium salt selected from the group consisting of a nitrate salt, a sulfate salt, a phosphate salt, a chloride salt, and any combination thereof; and an abrasive; wherein a pH of the composition is in a range of from approximately 2.0 to approximately 5.0; as recited in Claim 24, and Claims 30, 31 and 35 depending therefrom. By way of example, Small II's Post Clean Treatment solution is not itself a composition for the CMP of a surface having at least one feature thereon comprising copper as recited, and does not comprise a combination of elements including an abrasive as recited. Further by way of example, Small II's separate

silicon oxide-based abrasive slurry does not comprise hydroxylamine as recited, or a material as recited, and does not have a pH in a range as recited.

In view of the foregoing, it is believed that the foregoing rejections of Claims 24, 30, 31, 35 and 41 have been overcome. Withdrawal of these rejections is earnestly solicited.

Claims 25-28 and 37-39 have been rejected under 35 U.S.C. Section 103(a), as allegedly being unpatentable over Small II as applied to Claim 24 above, and further in view of United States Patent No. 6,347,978 of Fang *et al.* (hereinafter, "Fang"). These rejections are respectfully traversed.

At the outset, it is submitted that Small II is inapplicable to underlying Claim 24 as set forth in the remarks above, which are fully incorporated in this traversal by reference.

Additionally, Small II teaches that copper is a soft metal and that copper films are thus easily damaged by the abrasive particles in CMP slurries. (See Small II: col.6, ll.37-38; and col.10, ll.36-38.) Thus, it is clear that not every CMP composition is suitable for use in the CMP of copper, given that soft metal's propensity for damage by abrasive particles.

Fang teaches throughout his disclosure that its composition is specifically for polishing rigid disks, which are specifically defined as "rigid disks and hard disks, such as an aluminum disk or nickel phosphor (NiP) plated aluminum disk upon which a magnetic media for computer memories will be coated." (See Fang: col.2, ll.62-67.) Given Small II's teaching of copper as a soft metal that is particularly susceptible to damage by abrasive particles, it is submitted that one of ordinary skill in the art would not have been motivated to modify Small II's teaching by incorporating Fang's teachings regarding a composition for the CMP of hard, rigid disks, which are not taught or suggested as being so particularly susceptible to damage by abrasive particles. There is simply no teaching or suggestion in either Small II or Fang that a composition for the CMP of hard, rigid disks would be suitable for the CMP of soft, damage-susceptible, copper metal. Further, as Small II makes it clear that "[c]opper films present a difficult problem" (see Small II: col.6, ll.37-38) in this regard, one of ordinary skill in the art would have had no reasonable expectation of success in attempting, if at all (*arguendo*), such a modification. (See *In re Vaack*, 20 USPQ 2d 1438 (Fed.Cir. 1991).)

As to Claim 39, Fang fails to teach or suggest the use of a CMP composition comprising a milled alumina abrasive and teaches specifically against the use of a CMP

composition comprising a fumed alumina abrasive, as leading to high defectivity. (See Fang: col.6, ll.48-59.) In this regard, Fang teaches that in its composition for polishing rigid disks, the polishing abrasive is critical to achieving both a good removal rate and a good surface finish. Fang then teaches specifically against the use of a CMP composition comprising a fumed alumina abrasive, as it results in high defectivity or the worst defectivity amongst the compositions tested. Fang thus excludes alumina abrasive throughout when describing its composition. (See, for example, Fang: abstract; col.1, ll.8-9; col.2, ll.54-57; col.3, ll.4-10; col.3, ll.36-67; and col.6, ll.48-67.) There is simply no teaching or suggestion in either Small II or Fang, or the alleged combination thereof (*arguendo*), that would have led one of ordinary skill in the art to the invention recited in Claim 39.

It is respectfully submitted that Small II does not apply to the underlying Claim 24, as set forth previously, that one of ordinary skill in the art would not have been motivated to combine Small II and Fang in the manner alleged by the Examiner, and that even if one so skilled would have been so motivated (*arguendo*), one so skilled would not have arrived at the invention of Claims 25-28 and 37-39.

In view of the foregoing, it is believed that the foregoing rejections of Claims 25-28 and 37-39 have been overcome. Withdrawal of these rejections is earnestly solicited.

Claims 29, 33 and 34 have been rejected under 35 U.S.C. Section 103(a), as allegedly being unpatentable over Small II as applied to Claim 24 above, and further in view of International Application of Small *et al.* Published under the Patent Cooperation Treaty, bearing International Publication No. WO 98/04646 (hereinafter, "Small I").

At the outset, it is submitted that Small II is inapplicable to underlying Claim 24 as set forth in the remarks above, which are fully incorporated in this traversal by reference.

As to the rejection of Claim 33, the Examiner states that Small II fails to teach the recited composition wherein the insoluble complexing agent is selected from the group consisting of benzotriazole, 6-dioxaspirol [4,4] nonane 2,7-dione, dioximes, and any combination thereof. (See Office Action, page 5.) The Examiner further states that Small I teaches that "[i]n acid solutions an inhibitor, i.e., benzotriazole (BTA) is usually needed to control the isotropic etching effects from the chemistries used in the CMP process []." (See Office Action, pages 5-6.)

It is respectfully submitted that Small II fails to teach or suggest the invention of Claim 24, from which Claim 33 depends, as set forth in the remarks above, Small II fails to teach or suggest the invention of Claim 33, as conceded by the Examiner, and Small I fails to make up for the deficiencies of Small II as to Claim 33.

By way of example, as remarked upon above, Small II teaches that its abrasive-free Post Clean Treatment solution can be used to perform CMP of copper metal films, wherein that abrasive-free Post Clean Treatment solution is used to oxidize the copper metal surface and a separate slurry composition is used thereafter to abrade the resulting oxide surface. (See Small II: col.6, ll.2-6.) The Post Clean Treatment solution does not contain an abrasive and cannot be used alone to carry out the CMP process.

This Post Clean Treatment solution that does not contain an abrasive and that cannot be used alone to carry out a CMP process is disclosed as having a pH between about 3.5 and about 7, and is thus, an acid solution. (See, for example, Small II: abstract.) However, even if one of ordinary skill in the art were motivated (*arguendo*) to add Small I's benzotriazole to this acid solution, one so skilled still would not arrive at the invention of Claim 33. For example, the composition resulting from the acidic Post Clean Treatment solution and benzotriazole, *arguendo*, would still not contain an abrasive and would still not be usable alone to carry out a CMP process.

Further by way of example, as remarked upon above, Small II teaches that a separate abrasive slurry composition must be used after the abrasive-free Post Clean Treatment solution in the CMP process to abrade the resultant metal oxide surface. The only abrasive slurry compositions mentioned by Small II are silicon oxide-based slurries for which the pH is said to be important and needs to be in the 10 to 11.5 range. (See Small II: col.5, ll.31-33.) These slurries are thus basic. Small I only teaches benzotriazole in connection with acid solutions. One of ordinary skill in the art simply would not have been motivated to use benzotriazole in the basic silicon oxide-based slurries disclosed in Small II. Further, even if one of ordinary skill in the art would have been so motivated, *arguendo*, the composition resulting from the basic silicon oxide-based slurries and benzotriazole, *arguendo*, would still not comprise hydroxylamine as recited, or a material as recited, and would not have a pH in a range as recited.

In view of the foregoing, it is believed that the foregoing rejection of Claim 33 has

been overcome. Withdrawal of this rejection is earnestly solicited.

As to the rejection of Claim 34, the Examiner states that Small II fails to teach the recited composition wherein the insoluble complexing agent comprises 2,4-pentane dioxime. The Examiner further states that Small I teaches that “[i]t is possible to add chelating agents; i.e., alkyl beta-diketones (2,4 pentanedione, etc.) ... [.]” and that 2,4 pentanedione reads on 2,4-pentanedione dioxime. (See Office Action, page 6.) The Examiner concludes that it would have been obvious to modify Small II by adding an alkyl beta-diketone, such as Small I’s 2,4 pentandione, “as taught by Small [I] for the purpose [of] reacting ketone-based systems with hydroxylamine products to form oxime derivatives which are good chelating agents [.]” (See Office Action, page 6.)

It is respectfully submitted that Small II fails to teach or suggest the invention of Claim 24, from which Claim 34 depends, as set forth in the remarks above, Small II fails to teach or suggest the invention of Claim 34, as conceded by the Examiner, and Small I fails to make up for the deficiencies of Small II as to Claim 34.

By way of example, as remarked upon above, Small II teaches that its abrasive-free Post Clean Treatment solution can be used to perform CMP of copper metal films, wherein that abrasive-free Post Clean Treatment solution is used to oxidize the copper metal surface and a separate slurry composition is used thereafter to abrade the resulting oxide surface. (See Small II: col.6, ll.2-6.) The Post Clean Treatment solution does not contain an abrasive and cannot be used alone to carry out the CMP process. Thus, even if one of ordinary skill in the art were motivated (*arguendo*) to add Small I’s 2,4 pentanedione to this Post Clean Treatment solution, one so skilled still would not arrive at the invention of Claim 34. For example, the composition resulting from the Post Clean Treatment solution and 2,4 pentanedione, *arguendo*, would still not contain an abrasive and would still not be usable alone to carry out a CMP process. Further, such a resulting composition, *arguendo*, would still not contain 2,4-pentanedione dioxime.

Further by way of example, as remarked upon above, Small II teaches that a separate abrasive slurry composition must be used after the abrasive-free Post Clean Treatment solution in the CMP process to abrade the resultant metal oxide surface. The only abrasive slurry compositions mentioned by Small II are silicon oxide-based slurries for which the pH is said to be important and needs to be in the 10 to 11.5 range. (See Small II: col.5, ll.31-33.)

These silicon oxide-based slurries do not contain hydroxylamine-based products. Small I only teaches 2,4 pentanedione in connection with hydroxylamine-based products. Thus, one of ordinary skill in the art simply would not have been motivated to use 2,4 pentanedione in the silicon oxide-based slurries disclosed in Small II that do not contain hydroxylamine-based products. Further, even if one of ordinary skill in the art would have been so motivated, *arguendo*, the composition resulting from the silicon oxide-based slurries and 2,4 pentanedione, *arguendo*, would still not comprise hydroxylamine as recited, or a material as recited, or 2,4-pentanedione dioxime as recited, and would not have a pH in a range as recited.

In view of the foregoing, it is believed that the foregoing rejection of Claim 34 has been overcome. Withdrawal of this rejection is earnestly solicited.

The Examiner has failed to provide any *prima facie* showing as to the rejection of Claim 29, such that Applicants have no burden of rebuttal. It is submitted that Claim 29 is patentable over Small II as allegedly applied to Claim 24, and further in view of Small I, for at least the reasons set forth in the remarks above.

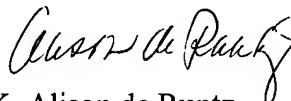
In view of the foregoing, it is believed that the foregoing rejection of Claim 29 has been overcome. Withdrawal of this rejection is earnestly solicited.

It is submitted that new Claims 57-70 are allowable over Small II, Fang, and Small I, alone or in any alleged combination, as the subject matter of these claims is neither taught or suggested by Small II, Fang, and Small I, alone or in any alleged combination. An indication that Claims 57-70 are allowed is earnestly solicited.

CONCLUSION

Claims 24-70 define novel and non-obvious subject matter of the present invention. Therefore, an early notification that the application is in condition for allowance is earnestly solicited.

Respectfully submitted,



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